

# Arthroscopic Reduction-Association of the Scapholunate with an Absorbable Screw

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## Abstract

**Background** The treatment of chronic scapholunate instability is yet a controversial topic. Arthroscopic reduction-association scapholunate technique is a minimally invasive option in which a stable pseudoarthrosis at the scapholunate joint is obtained, allowing some degree of movement while maintaining the normal alignment of the wrist. The purpose of this study was to review the results of arthroscopic reduction-association scapholunate with an absorbable screw.

**Methods** We retrospectively evaluated patients with dynamic or static, but reducible, chronic scapholunate instability who underwent arthroscopic reduction-association scapholunate between 2012 and 2015. An absorbable headless compression screw was used in the technique.

**Results** A total of 33 patients (21 males, 12 females) were included. Average follow-up time was 17 months. At final follow-up, the average postoperative Disabilities of the Arm, Shoulder and Hand (DASH) score was 18 (range, 8–46). The average postoperative grip strength was 30 kg, 73% of the uninjured side. The average extension-palmar flexion arc was 112 degrees, 79% of the uninjured side. The scapholunate angle decreased from 70 degrees preoperatively to 52 degrees postoperatively. In the cases of static lesion, the scapholunate interval decreased from 4.1 mm preoperatively to 2.8 mm at final follow-up. One patient had a breakage of the screw at 4 months, four developed a complex regional pain syndrome, one had a prominence of the screw at the waist of the scaphoid, and four maintained symptoms of instability. From these 10 patients, 5 were submitted to revision surgery.

**Conclusion** The arthroscopic reduction-association technique is capable of maintaining the reduction of the scapholunate joint and of improving symptoms, while preserving range-of-motion. The use of an absorbable screw is an option in this technique, and may diminish screw-related complications.

## Keywords

- scapholunate dissociation
- carpal instability
- reduction-association scapholunate
- arthroscopic surgery
- absorbable screw

Injuries to the scapholunate interosseous ligament (SLIL) are relatively common, representing one of the most frequent types of carpal instability. Being an intra-articular ligament, it has a poor healing potential.<sup>1</sup> Moreover, the natural history and the rate of progression to SL advanced collapse (SLAC) is poorly understood.

In the acute cases, many authors prefer the anatomic repair, combined or not with an augmentation technique (capsulodesis). In a vast number of patients, the prompt diagnosis is not accomplished and the repair of the ligament is impossible. The approach to these cases is controversial. In general, several techniques could achieve 60 to 80% wrist motion of the

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contralateral side, and grip strength averages 65 to 90%.<sup>2</sup> Nonetheless, the majority fail to maintain the normal kinematics of the wrist that would prevent the progression to SLAC.

Rosenwasser et al described the reduction-association SL (RASL) as a procedure in which a stable pseudoarthrosis at the SL joint is obtained, allowing some degree of movement while maintaining the normal alignment of the wrist.<sup>3</sup> After the reduction, a screw is placed with the intention to support the scaphoid and lunar alignment while the fibrous union develops.

Aviles et al modified this procedure to an arthroscopic RASL (ARASL), allowing direct visualization of the lesion and screw placement with minimal soft tissue disruption.<sup>4</sup> Caloia et al reviewed eight patients (nine wrists) who had ARASL for SL instability with a chronic but reducible SLIL tear with a mean postoperative Disabilities of the Arm, Shoulder and Hand (DASH) score of 22, and three wrists had screw removal.<sup>5</sup> Koehler et al reported 18 patients underwent the ARASL with a mean DASH score of 8. Seven patients suffered complications and four of them underwent reoperation.<sup>6</sup>

In this study, using absorbable screw in the ARASL, we evaluated the outcomes and complications of this technique in 33 consecutive patients.

## Methods

We retrospectively evaluated 33 patients with chronic SL instability who underwent the ARASL technique between 2012 and 2015. There were 21 males and 12 females with an average age of 26 (range: 17–58) years. Average follow-up

time was 17 (range: 12–22) months. All patients had symptoms of wrist pain, and the dominant hand was involved in 21 cases (64%). Twenty-two patients had a dynamic SL lesion and 11 had a static, but reducible SL lesion. The diagnosis was based in the clinical examination and supported with conventional or dynamic radiology. All the procedures were performed by the senior author (F.T.). Inclusion criteria included dynamic or static but reducible SL instability on preoperative radiographs (–**Figs. 1** and **2**) and minimum follow-up of 12 months. Exclusion criteria were skeletally immature patients, prior wrist surgery or infection, degenerative changes, or lunotriquetral or mid-carpal instability.

## Technique

The surgical technique was performed along with Aviles et al.<sup>4</sup> An arthroscopy traction tower was used. A 3 to 4 portal and radial mid-carpal portal were made to inspect the radiocarpal joint and SL space. After confirming the instability, the articular surfaces were prepared at the SL interval with a shaver until punctate bleeding was observed, without decortication of the referred surfaces. The traction tower facilitated the reduction, and when necessary was aided by the positioning of a 1.6-mm Kirschner wire in the distal pole of the scaphoid and another at the distal medial corner of the lunate. Under arthroscopic and fluoroscopy control, the anatomic reduction was achieved, with extension and supination of the scaphoid and flexion of the lunate. In the static cases, a scapho-capitate pinning with two Kirschner wires maintained the reduction while the screw was placed. Rarely a radiolunar pinning was needed.



**Fig. 1** Preoperative anteroposterior X-ray from a patient with a static scapholunate dissociation.



**Fig. 2** Preoperative lateral X-ray from a patient with a static scapholunate dissociation.



**Fig. 3** Postoperative anteroposterior X-ray from a patient with a static scapholunate dissociation.



**Fig. 4** Postoperative lateral X-ray from a patient with a static scapholunate dissociation.

Through a 1-cm longitudinal incision distal to the radial styloid, and dissection up to the waist of the scaphoid was made with mosquito forceps, the guide wire was introduced to the waist of the scaphoid and passed through the SL joint until it reaches the lateral corner of the lunate. The hardware used was an absorbable headless compression screw (Biotrak standard screw, Acumed, Hillsboro, OR). The objective was to position the screw in the center of the SL joint and parallel to the radiocarpal joint (► **Figs. 3 and 4**). To assess the size, we usually subtracted 4 mm to the measured length. The screw was then inserted, always checking its correct trajectory and the proper anatomic carpal alignment. No ligament repair or capsulodesis was necessary.

After arthroscopic and fluoroscopy confirmation of the reduction, Kirschner wires were removed and the skin sutured. A short-arm cast was placed and postoperative finger exercises were initiated. At 6 weeks, the cast was removed and gentle wrist movements were initiated. Rehabilitation began 8 weeks after the surgery. Forceful gripping was allowed 12 weeks after the surgery (► **Figs. 5 and 6**).

### Assessment

The patients were assessed with ranges of motion (ROMs) using a goniometer, grip strength using a hand dynamometer, and a DASH questionnaire. Preoperative and postoperative SL angle and gap were measured, averaged, and reported. Postoperative complications and revision operations were also documented.



**Fig. 5** Follow-up anteroposterior X-ray from a patient with a static scapholunate dissociation at 6 months.



**Fig. 6** Follow-up lateral X-ray from a patient with a static scapholunate dissociation at 6 months. Red arrow indicates the tunnel created by the screw passing in the semilunar axis.

Results

Clinical Outcome

At final follow-up, the average postoperative DASH score was 18 (range: 8–46) as compared with the average preoperative DASH score of 54 (range: 36–67). The postoperative grip strength was in average 30 (range: 15–48) kg, 73% of the uninjured side (average 41 kg). The average extension–

flexion arc was 112 (range: 78–130) degrees, 79% of the uninjured side (average 142 degrees). All patients returned to its normal activity, although three needed some kind of workplace conversion.

Radiographic Assessment

The radiographs demonstrated a reduction in the SL angle, in average 70 (range: 48–86) degrees preoperative to 47 degrees at 6 to 8 weeks, and 52 (range: 37–71) degrees at final follow-up. In the cases of static lesion, the average SL interval decreased from 4.1 (range: 3.0–8.0) mm preoperative to 2.1 mm at 6 to 8 weeks, and 2.8 (range: 0–5.0) mm at final follow-up. No case of progression to SLAC was reported at final follow-up.

Complications

Four had an unsuccessful procedure, with recurrence of the symptoms and increase of the SL interval, and later on they underwent the modified Brunelli tenodesis within the first 4 months (–Table 1). One patient reported a “snap” during rehabilitation at 6 months of follow-up, with no correlation on the X-ray, and subsequent magnetic resonance imaging (MRI) revealed a breakage of the screw. Nonetheless, the patient had no symptomatic repercussion or increase in the SL angle or SL interval. Four patients developed prolonged complex regional pain syndrome, and two of these remained wrist contracture (ROM < 90 degrees). One patient had a radial conflict due to prominence of the screw at the waist of the scaphoid, and later underwent excision of the head of the screw trough a miniopen incision.

Discussion

The SL ligament is the essential intrinsic stabilizer of the SL joint. The SL ligament injury is one of the most common causes of carpal instability. It may be classified as dynamic when the extrinsic stabilizers are intact and static when the extrinsic stabilizers are injured.<sup>7</sup> In general, it should be done when the injury is acute and repairable. On the other hand, when the lesion is static and nonreducible, or when there is some kind of degeneration (SLAC), the majority of the

**Table 1** Complications and reoperations

Patient	Complication	Reoperation
1	Breakage of the screw	
2	Complex regional pain syndrome	
3	Conflict due to prominence of the screw at the scaphoid	Excision of the radial end of the screw
4	Recurrent pain	Modified Brunelli tenodesis
5	Recurrent pain	Modified Brunelli tenodesis
6	Complex regional pain syndrome	
7	Complex regional pain syndrome	
8	Recurrent pain	Modified Brunelli tenodesis
9	Recurrent pain	Modified Brunelli tenodesis
10	Complex regional pain syndrome	

authors prefer a salvage procedure, like a proximal row carpectomy, denervation, and partial or total wrist fusion.

The Garcia-Elias stages III and IV of the SL ligament injuries propose a more difficult challenge to the hand surgeon. Techniques described as ligament reconstruction,<sup>8</sup> capsulodesis,<sup>9–14</sup> or tenodesis procedures<sup>15–18</sup> do not reliably restore normal alignment and mechanics to the carpal bones, and the results are short of excellent. SL fusions have the highest nonunion rate of the carpal arthrodesis, 62.5%,<sup>19</sup> but that did not prevent good clinical results.<sup>20</sup> Rosenwasser et al concluded that an intentional fibrous union, or neoligament, could lead to a stable union and normal alignment while allowing some kind of movement, resembling a more normal wrist kinematics. Moreover, since the screw does not contact other bones, this technique could be converted into a salvage procedure if necessary (proximal row carpectomy or wrist arthrodesis).<sup>3</sup>

Arthroscopic and mini-invasive techniques decrease soft-tissue damage, and arthroscopic examination permits a precise reduction of the joint and placement of the screw, as described by Aviles et al.<sup>4</sup> The arthroscopy also can examine the integrity of the entire wrist, identifying additional and unexpected lesions. Caloia et al obtained a mean postoperative DASH score of 22, the grip strength was 78% of the contralateral unaffected wrist, and the average wrist ROM was 107 degrees, 20% less than the preoperative ROM. The SL angle decreased from 70.5 degrees preoperative to 59.3 degrees postoperative. The SL gap was 3.8 mm before and 2.5 mm after surgery.<sup>5</sup> Koehler et al reported a mean postoperative DASH score of 8, and the grip strength was 84% (27 kg) on the operative side compared with the uninjured side (32 kg). The mean wrist ROM was 102 degrees (46 degrees of flexion and 56 degrees of extension). The mean SL angle of 73 degrees before surgery was reduced to 64 degrees, and the SL gap from 5.5 to 3.2 mm postoperatively at final follow-up.<sup>6</sup>

In this study, our clinical and radiographic results were similar to the previous reports.<sup>4–6</sup> This indicates that the arthroscopic RASL technique is capable of maintaining the reduction of the SL joint. Moreover, it seems to improve symptoms while preserving more ROM than other procedures.

Caloia et al noted that three of nine wrists (33%) required screw removal.<sup>5</sup> In fact, some authors recommended the removal of the screw after a few months in the RASL technique,<sup>21</sup> and the use of a screw to stabilize the SL interval has been a major critic to this, due to the potential long-term harmful effects of leaving the screw in place.<sup>22</sup> Koehler et al described 7 out of 18 cases with complications (39%), 6 with SL joint widening and one windshield wiper of the screw with subsequent loss of reduction. Two wrists progressed to SLAC. Four patients (22%) underwent a second procedure, two revisions ARASL and two proximal row carpectomy. They also noted in their series that a preoperative SL gap greater than 5 mm and the presence of SLAC were both predictive of complication or revision surgery.<sup>6</sup> We opted for an absorbable screw aiming to decrease the need of screw removal and complications. A lower reoperation rate, five patients (15%), was achieved with a total of 10 cases with complications (30%). Only two complications were related to

the screw; one breakage of the screw and one screw with head protrusion that can be considered technical error.

Taking this into account, the use of an absorbable screw can be an option in the ARASL technique.

Limitations of this study include the short follow-up period, and a limited number of subjects with diverse radiographic and clinical severity. Prospective studies, with a longer follow-up, are necessary to validate these findings and provide hand surgeons better management options for this problem.

#### Note

All authors were fully involved in the study and preparation of the manuscript. This material has not been and will not be submitted for publication elsewhere.

#### Funding

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#### Conflict of Interest

None.

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